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# **emPC-A/iMX6**

embedded PC

(Hardware Manual)

Version 1.7

refers to product revision no.

x.x

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## About this Manual

This is the hardware manual for the emPC-A/iMX6 embedded PC.

Throughout the manual, the term emPC-A/iMX6 is used to identify the all systems. When required, the letters S/D/Q are appended for Solo, Dual or Quad.

For more detailed programming information refer to the ix-Bus System Reference Manual.

## Conventions

If numbers are specified in this manual, they will be either decimal or hexadecimal. We use C-notation to identify hexadecimal numbers (the 0x prefix).

If we refer to low active signal names, they will suffixed by a “#” character.

Some parts of the document contain notices you have to observe to ensure your personal safety, or to prevent damage to property. These are visually marked with the following alert symbols:



### **DANGER / DANGER**

Indicates that death or severe personal injury *will* result if proper precautions are not taken.

Indique que des blessures corporelles graves, voire fatales, seront causées si les précautions nécessaires ne sont pas prises.



### **WARNING / AVERTISSEMENT**

Indicates that death or severe personal injury *may* result if proper precautions are not taken.

Indique que des blessures corporelles graves, voire fatales, *peuvent* être causées si les précautions nécessaires ne sont pas prises.



### **CAUTION / ATTENTION**

Indicates that *minor* personal injury can result if proper precautions are not taken.

Indique que des blessures corporelles *mineures* peuvent être causées si les précautions nécessaires ne sont pas prises.



### **NOTICE / REMARQUE**

Indicates that damage to equipment can result if proper precautions are not taken.

Indique que des dommages matériels peuvent être causés si les précautions nécessaires ne sont pas prises.



Indicates information that we think you should have read to save your time by avoiding common problems. Important suggestions that should be followed will also be marked with this sign.

## Acronyms and Abbreviations

EMC	Electromagnetic capability.
ESD	Electrostatic discharge.
GND	System ground potential. Inside the product this is connected to the metal housing, which might be connected to protective earth by the installation. There exist some isolated reference grounds for communication interfaces or IO. These reference signals are referred to as GND-x, where x indicates function.
SELV	Safety extra low voltage.





# 1 Introduction

## 1.1 Features

### 1.1.1 Standard Products

- Freescale i.MX6 application processor
- Single-, Dual- or Quad-Core CPU based on ARM Cortex-A9 800 MHz, with ARMv7™, Neon, VFPv3 and Trustzone support
- Fanless cooling concept
- 32 kB instruction and data L1 caches and 256 kB to 1 MB of L2 cache
- System memory 2 GB DDR3 (1GB with Solo)
- 128 kB of MRAM which does not require battery backup
- Internal CFast Socket for SATA SSD (not available for Single-Core CPU type)
- Internal SDcard socket
- Superior 3D graphics performance with up to quad shaders performing 200 Mt/s and OpenGL support
- Separate 2D and/or Vertex acceleration engines for an optimal user interface experience
- DVI-D graphic interface on front panel (Single Link)
- internal LVDS display interface
- Single channel LVDS on internal connector
- 2 x 10/100/1000 Mbit/s Ethernet
- 2 x USB 2.0 interface (480Mbit/s)
- Battery backed up RTC
- System Power supply 9..34 VDC
- Reset Push Button and Power LED
- 2 male 9pin D-SUB connectors, utilized by serial ports or CAN
- Power supply monitor

### 1.1.2 Hardware Customization

Due to its flexible system architecture, the emPC-A/iMX6 can be customized if the standard products do not provide optimum features or price. Customization is possible even at moderate quantities. Ask sales department for details.

Following you find a (non-complete) list of possible customizations:

- Internal eMMC with up to 16 GByte. Soldered to PCB for improved mechanical reliability.
- Without MRAM for price reduction.
- Serial ports can be modified for RS485 physical layer (optionally isolated)
- More CAN ports are possible by using expansion cards (in a larger housing)
- More serial ports are possible
- Digital/Analog-IO expansion card
- Customer specific expansion cards
- Other mounting options (e.g. flange mount)

### 1.1.3 Software

Supported by

- Linux

Contact Janz Tec for more information about the available software packages.

The emPC-A/iMX6 is equipped with the u-boot bootloader software.

## 1.2 Ordering Information

### 1.2.1 Standard Systems

Material Number	Name/Type	
SY-EPC-6X00Y	emPC- <b>yyyy/z</b>	Generic number
KD-KKK-6X00Y	emPC- <b>yyyy/z</b>	Generic number
SY-EPC-62000	emPC-A/iMX6D/0	Dual Core, 2xRS232
SY-EPC-64000	emPC-A/iMX6Q/0	Quad Core, 2xRS232
SY-EPC-64001	emPC-A/iMX6Q/1	Quad Core, 1xCAN/1xRS232
SY-EPC-64002	emPC-A/iMX6Q/2	Quad Core, 2xCAN
SY-EPC-64005	emPC-A/iMX6Q/5	Quad Core, 1xCAN/1xRS232, analog/dig. IO

- **yyyy** can be A/iMX6S or A/iMX6D or A/iMX6Q (type of processor Single, Dual or Quad)
- **z** can be 0,1,2,3,... Interface variant (CAN/RS485/RS232, digital IO)
- **X** can be 1,2,4 System variant (CPU Model).
- **Y** can be 0,1,2,3,... Interface variant (CAN/RS485/RS232, digital IO)
- **KKK** can be customer specific variant

### 1.2.2 OEM Variants

OEM Material Number	Name/Type	
KD-VOI-6LS0C	BlueBox	Base System
KD-VOI-6LS1C	BlueBox	System with digitale I/O
KD-VOI-6LS2C	BlueBox	System with digital und analoge I/O

- **S**: can be 0,1,2,3,... Software variant
- **C**: can be 1,2,3,4,... Interface variant (CAN/RS485/RS232)
- **L**: can be 4 (standard) or 5 (coated PCB)

### 1.3 Functional Overview

The emPC-A/iMX6 is built upon a couple of standard building blocks, as shown in figure 1.

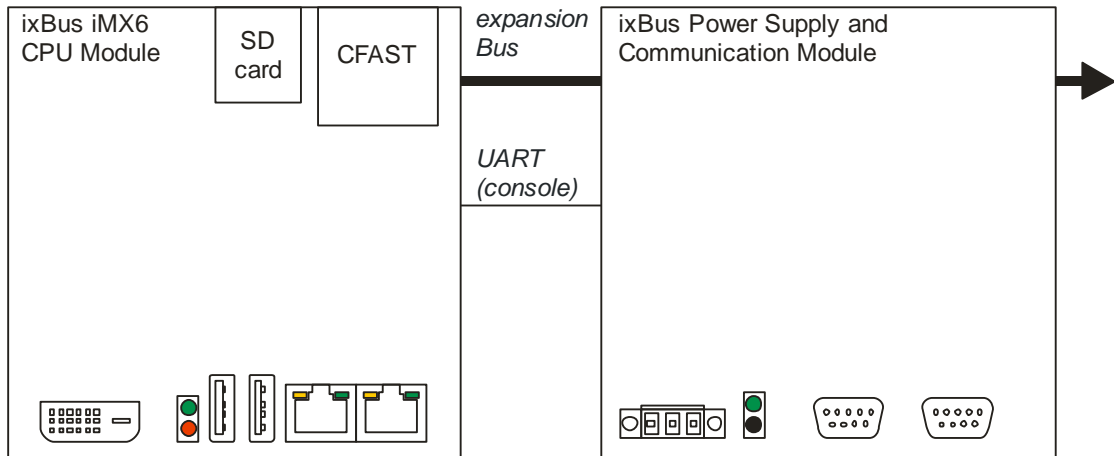


figure 1: block diagram (2 PCB variant shown)

The system consists of the following building blocks:

- Janz Tec ix-Bus i.MX6 CPU module
- Janz Tec ix-Bus power supply and communication module
- Optionally additional IO modules

Refer to Janz Tec ixBus System Reference Manual for details on the Janz Tec specific building blocks.

## 2 Safety Instructions

Refer to page iv for explanation of the warning notice system.

The product described in this documentation may be operated only by personnel qualified for the specific task in accordance with the relevant documentation for the specific task, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products.

### 2.1 Installation and Maintenance



#### NOTICE / REMARQUE

The product is intended to be used in industrial environments. Typical applications are process visualization or as a controller for industrial automation.

Ce produit est destiné à être utilisé dans un environnement industriel. Les applications typiques sont la visualisation de processus ou comme contrôleur pour l'automatisation industrielle.



#### **DANGER / DANGER : Electrical Shock / Risque d'électrocution**

Danger to life.

This product operates with 9..34 V DC SELV power supply. Do not connect this product to an improper power supply.

Danger de mort :

Ce produit fonctionne avec une alimentation 9..34 V CC SELV. Ne branchez pas cet appareil à une alimentation électrique inadéquate.



#### **DANGER / DANGER : Electrical Shock / Risque d'électrocution**

Danger to life.

The IO interfaces (connectors) of the product are only suited to be connected to SELV circuits. Use interfaces (connectors) for their intended use only.

Danger de mort :

Les interfaces d'E/S (connecteurs) du produit ne peuvent être raccordées qu'à des circuits SELV. N'utilisez les interfaces (connecteurs) qu'aux fins prévues.



#### **CAUTION / ATTENTION : Explosiv Risk / Risque Explosif**

The installed computer board is equipped with a Lithium battery.

Danger of explosion if battery is incorrectly replaced. Replace only with battery of the same or equivalent type.

Le boîtier de l'ordinateur installé est équipé d'une batterie au lithium.

Risque d'explosion si la batterie n'est pas remplacée de façon conforme. Remplacer uniquement par une batterie de type identique ou équivalent.



#### **CAUTION / MISE EN GARDE : Fire Risk / Risque d'incendie**

The digital IO must be powered by a SELV power supply, that complies with the requirements of a limited energy source (LPS) (By using an appropriate supply or an external fuse).

L'E/S numérique doit être alimenté par une alimentation SELV, conforme aux exigences d'une source d'énergie limitée (LPS) (en utilisant une alimentation appropriée ou un fusible externe).

**WARNING / ATTENTION : Burns Hazard / Risque de brûlures**

The product generates considerable amount of heat. The housing transports this heat to the environment and therefore gets hot. **Caution when touching the housing, burns hazard!**

Le produit génère une quantité considérable de chaleur. Le boîtier transmet cette chaleur à l'environnement et devient très chaud. **Attention en touchant le boîtier, risque de brûlures !**

## 2.2 Ambient and Environmental Conditions

**CAUTION / ATTENTION : Damage / Dommage**

Do not operate the product beyond the specified ambient conditions. Do not cover the ventilation holes/slots of the product.

Ne pas faire fonctionner le produit au-delà des conditions ambiantes indiquées. Ne pas recouvrir les trous/fentes d'aération du produit.

**DANGER / DANGER : Explosive Risk / Risque Explosif**

Do not operate the product in potentially explosive atmosphere.

Ne pas faire fonctionner le produit dans une atmosphère potentiellement explosive.

**NOTICE / REMARQUE : EMI / IEM**

This product is a class A device. This product may cause radio interference. In this case the user must take adequate measures.

Ce produit est un appareil de classe A. Ce produit peut générer des interférences radio. Dans ce cas, l'utilisateur doit prendre les mesures adéquates.

## 3 Intended use

The emPC-A/iMX6 is designed for computing purposes in industrial environments. It is destined to be used indoor only.

### 3.1 Disposal and Recycling

Janz Tec products are manufactured to satisfy environmental protection requirements where possible. Some of the components used are capable of being recycled. Final disposal of this product after its service life must be accomplished in accordance with applicable country-, state-, or local-laws or -regulations.



This product contains a lithium battery. This should be removed before disposal and be returned separately



Don't forget to delete all sensitive data on the product before disposal. Especially delete all person related data.

#### 3.1.1 EU

Janz Tec electronic products are labelled with the crossed-out trash can. This means that the products **must not** be disposed into the domestic garbage.

Used Janz Tec products have to be recycled properly. If in doubt, you can return them to Janz Tec at your own expense. Refer to <https://www.janztec.com/recycling> or contact Janz Tec under [recycling@janztec.com](mailto:recycling@janztec.com) for more instructions how and where to return the products.

#### 3.1.2 Germany

All Janz Tec products are registered as B2B custom at the german EAR. Hence Janz Tec products **must not** be disposed to public collection points for used electronic equipment. Refer to §14 of General Terms & Conditions of Janz Tec AG for the details regarding the mutual obligations as to the disposal of Janz Tec products.

The Lithium battery included in the product is registered at "GRS Batterien" and can be disposed to public collecting points for used batteries.

As stated above, used Janz Tec products can also be returned to Janz Tec at you own expense for free-of-charge recycling.

## 4 Installation

**WARNING / ATTENTION : Burns Hazard / Risque de brûlures**

The product generates considerable amount of heat. The housing transports this heat to the environment and therefore gets hot. **Caution when touching the housing, burns hazard!**

Le produit génère une quantité considérable de chaleur. Le boîtier transmet cette chaleur à l'environnement et devient très chaud. **Attention en touchant le boîtier, risque de brûlures !**

The product can be operated with DC power supply from 9 to 34 V.

### 4.1 Mounting

The emPC-A/iMX6 is intended for DIN rail mount. Refer to figure 2 for the recommended mounting orientation.

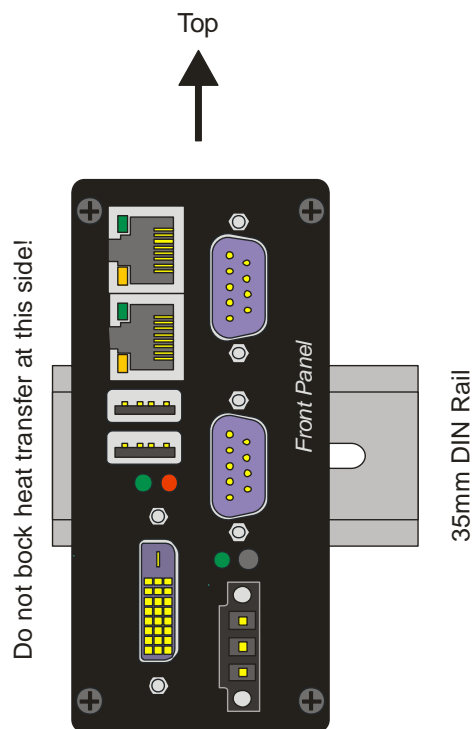


figure 2: emPC-A/iMX6 mounting options

## 4.2 Connectors and Operators

The emPC-A/iMX6 is equipped with differing interfaces. The following interfaces are common for all systems: DVI-D, 2 x USB 2.0, 2 x 10/100/1000 Mbit/s Ethernet. Depending on which alternative was ordered additional interfaces are available. The following table shows the standard systems.

Product	Interface	Linux	Address
emPC-A/iMX6/0	Serial-0 (Console)	/dev/ttymx0	
	Serial-1 (Console)	/dev/ttymx1	
emPC-A/iMX6/1	Serial (Console)	/dev/ttymx0	
	CAN	/dev/pcan_0	MOD_BASE
emPC-A/iMX6/2	CAN0	/dev/pcan_0	MOD_BASE
	CAN1	/dev/pcan_1	MOD_BASE + 0x200
emPC-A/iMX6/4	CAN0	/dev/pcan_0	MOD0_BASE
	CAN1	/dev/pcan_1	MOD0_BASE + 0x200
	CAN2	/dev/pcan_2	MOD1_BASE
	CAN3	/dev/pcan_3	MOD1_BASE + 0x200

Table 1: Interfaces connected to D-SUB

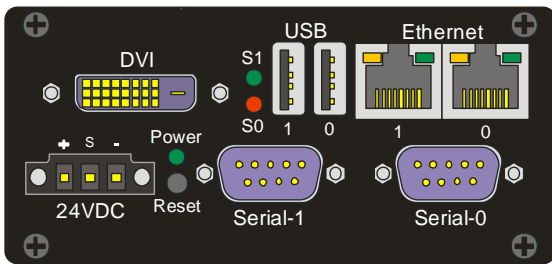


Figure 3: emPC-A/iMX6/0 interfaces

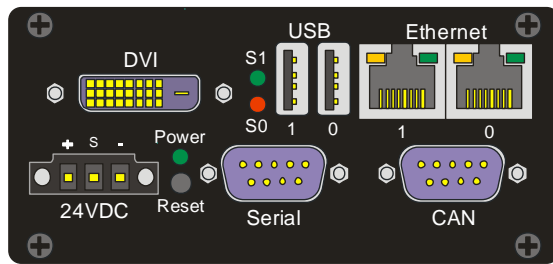


Figure 4: emPC-A/iMX6/1 interfaces

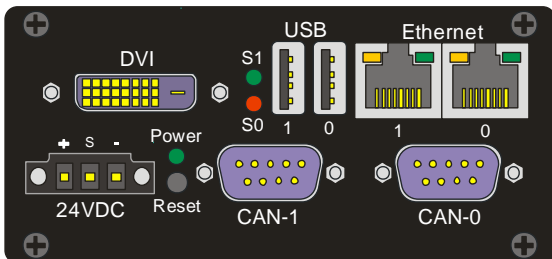


Figure 5: emPC-A/iMX6/2 interfaces

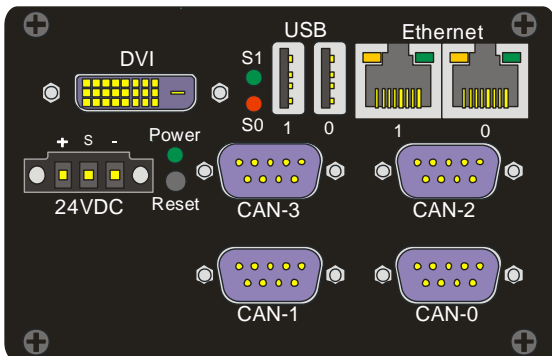


Figure 6: emPC-A/iMX6/4 interfaces

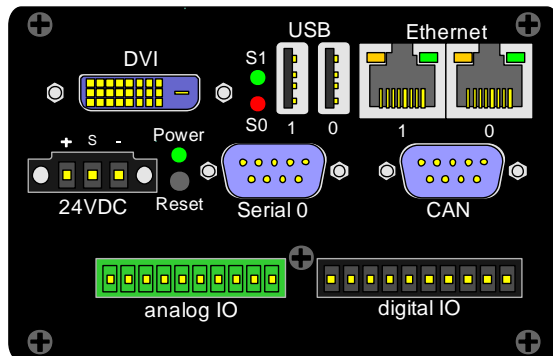
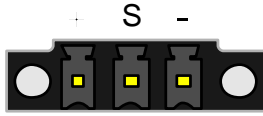


Figure 7: emPC-A/iMX6 with IO expansion



### 4.2.1 POWER IN

The system power supply is connected with a 3 pin screw terminal with 5.08 mm pitch.



Pin	Description
1 (+)	+9 ..34 VDC
2 (S)	Control input (0 .. 34 V)
3 (-)	GND

Figure 8: Power connector

Table 2: Power connector pin assignment

A suitable mating connector is Phoenix Contact 1900895. Equivalent Models exist from other vendors.



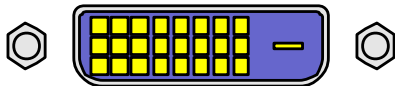
#### **DANGER / DANGER : Electrical Shock / Risque d'électrocution**

The product may only be operated with power supplies which can be considered SELV circuits.

Ce produit ne peut être utilisé qu'avec des alimentations qui peuvent être considérées comme des circuits SELV.

### 4.2.2 Graphics connector (DVI)

Combined digital and analog graphics connectors. The digital interface provides single link only.

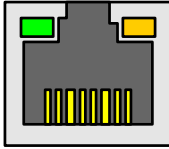


1	TMDS 2-	13	N/C
2	TMDS 2+	14	+5V
3	SHIELD	15	GND
4	N/C	16	Hotplug detect
5	N/C	17	TMDS 0-
6	DDC clock	18	TMDS 0+
7	DDC data	19	SHIELD
8	N/C	20	N/C
9	TMDS 1-	21	N/C
10	TMDS 1+	22	SHIELD
11	SHIELD	23	TMDS C+
12	N/C	24	TMDS C-

table 3: DVI-D connector

### 4.2.3 Ethernet Interfaces (Ethernet1 and Ethernet2)

Ethernet interfaces of the motherboard. The Ethernet physics is 10/100/1000BaseT, available through the shielded modular jack at the connector panel. Twisted pair cable can be used to connect to this port.

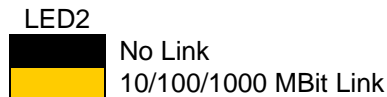


1	MDIO+	5	MDI2+
2	MDIO-	6	MDI2-
3	MDI1+	7	MDI3+
4	MDI1-	8	MDI3-

1

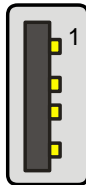
table 4: Ethernet connector

The two LEDs indicate Ethernet status as follows:



#### 4.2.4 USB type A receptacle (USB0-USB1)

Two USB interfaces are available at the connector panel.

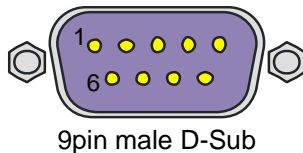


1	+5V, I <sub>MAX</sub> = 500 mA
2	USB-
3	USB+
4	GND

table 5: USB connector

## 4.1 RS232 (Console)

The RS232 (Console) serial interface is provided by the i.MX6 CPU. The connector is a standard 9 pin D-SUB plug, but the interface is connected with four wires only, table 6 shows the pin out.

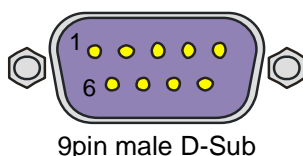


1	n.c.	6	n.c.
2	RxD	7	RTS
3	TxD	8	CTS
4	n.c.	9	n.c.
5	GND		

table 6: RS232 (Console) connector

## 4.2 RS232 (UART)

Additional serial interfaces might be implemented by a XR16V2750 dual UART chip. This type of serial port has proprietary implementation over the internal expansion bus. Hence it needs special software driver. For a description of UART registers refer to the EXAR manual. The UART clock input is 14,7456MHz to allow error free generation of standard baud rates. This RS232 variant provides all 8 interface signals as shown in table 7.

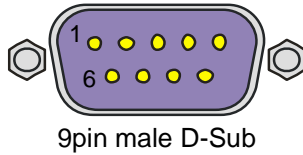


1	DCD	6	DSR
2	RxD	7	RTS
3	TxD	8	CTS
4	DTR	9	RI
5	GND		

table 7: RS232 connector

### 4.3 RS485

In the RS485 variant, there are only the differential signals D+ and D- provided. The transceiver is enabled to send data, when RTS# of the corresponding UART is low. Hardware can be customized to either receive or not-receive (standard) the transmitted data on the UART's RxD input. Ask Janz Tec for customization regarding this option.



1	n.c.	6	GND
2	D+	7	D-
3	GND	8	n.c.
4	n.c.	9	n.c.
5	n.c.		

table 8: RS485 connector

The bidirectional differential signals D+ and D- are provided. When the transmitter is enabled, and no data is send (1=MARK), then  $D+ > D-$  (refer to figure 9).

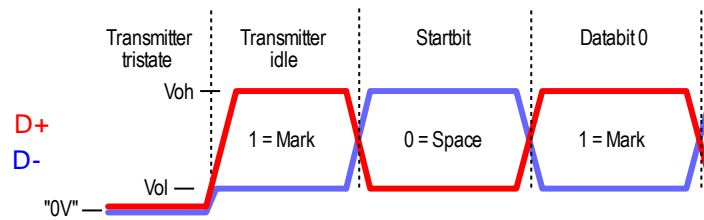


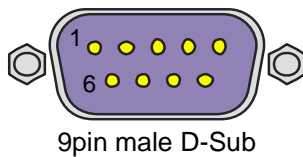
figure 9: RS485 signaling

Note that D+ corresponds to pin "A" of the transceiver chip. However, this is signal B according to the EIA-485 or Profibus standards.

The receiver has the failsafe input feature, which ensures that no data is received when D+ and D- are floating or are shorted (e.g. by the termination resistor).

### 4.4 CAN

The CAN interface is implemented with a SJA1000 controller chip. The connector is a standard 9 pin D-SUB plug with a pin out shown in table 9. The CAN interface is isolated and has a software switchable 120 Ohm termination.



1	n.c.	6	GND
2	CANL	7	CANH
3	GND	8	n.c.
4	n.c.	9	VEXT <sup>1</sup>
5	n.c.		

table 9: CAN connector

<sup>1</sup> This signal is optionally available to provide power to supply an external transceiver module

## 4.5 Digital IO



10pin 3.81mm connector

1	DIGIO-0
2	DIGIO-1
3	DIGIO-2
4	DIGIO-3
5	EXTVCC (24VDC nom.)
6	EXTGND
7	DIGIO-4
8	DIGIO-5
9	DIGIO-6
8	DIGIO-7

table 10: digital IO connector



### CAUTION / MISE EN GARDE : Fire Risk / Risque d'incendie

The digital IO must be powered by a SELV power supply, that complies with the requirements of a limited energy source (LPS) (By using an appropriate supply or an external fuse).

L'E/S numérique doit être alimenté par une alimentation SELV, conforme aux exigences d'une source d'énergie limitée (LPS) (en utilisant une alimentation appropriée ou un fusible externe).

The digital inputs and outputs are isolated from system power supply. Refer to figure 10 for detailed schematic.

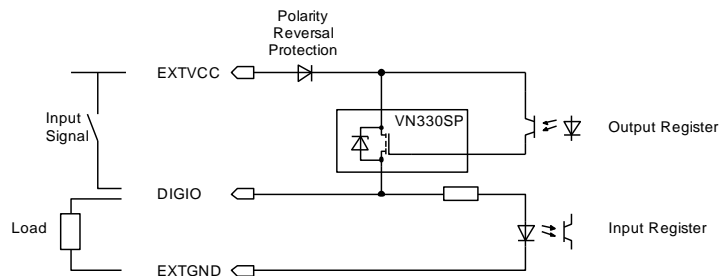


figure 10: digital IO input/output schematic

When used as digital input signals, DIGIO-X refer to EXTGND and have an input impedance of about 10 kOhm. Switching level for *low* is  $\leq 4.5$  V and *high*  $\geq 10$  V.



The digital inputs do not require EXTVCC to be present (can be left open). However, if EXTVCC is left open, the digital inputs back-power the output driver, resulting in increased input current.



### NOTICE / REMARQUE

When channels are used as inputs, make sure the voltage at DIGIO-X never exceeds the voltage at EXTVCC.

Lorsque des canaux sont utilisés comme entrées, assurez-vous que la tension sur DIGIO-X ne soit jamais supérieure à la tension sur EXTVCC.

When used as digital outputs, DIGIO-X drive EXTVCC power to the output pins (high side switch). The load must be connected between the output pin and the return of the VIO power supply. This return has to be connected to EXTGND as well.

Digital outputs can source 500mA per output. The output current sum of all digital outputs should be limited to 2500 mA. This is only a thermal limit to reduce power dissipation.

Digital outputs are powered by two output drivers (DIGIO-7..4 and DIGIO-3..0). High current loads should be distributed if possible. Two or more digital outputs can be used in parallel to enable switching higher currents.

The output driver supports resistive and inductive loads.



#### NOTICE / REMARQUE

When using inductive loads, the output driver has internal clamping to demagnetize the load. This clamps the output pin to about 55 V below VIN. When using this feature, very carefully evaluate that the demagnetization energy does not overheat the output driver. Parameters to check are the switching frequency, the load current, the load inductance and VIO voltage. Refer to the VN330SP datasheet for more information. If in doubt, add external clamping circuits.

Lors de l'utilisation de charges inductives, le pilote de sortie dispose d'un serrage interne pour démagnétiser la charge. La broche de sortie est ainsi bloquée à environ 55 V sous le NIV. Si vous utilisez cette fonction, veuillez contrôler que l'énergie de démagnétisation ne surchauffe pas le pilote de sortie. Les paramètres à vérifier sont la fréquence de commutation, le courant de charge, l'inductance de charge et la tension VIO. Pour plus d'informations, consulter la fiche technique du VN330SP. En cas de doute, ajouter des circuits de serrage externes.



#### NOTICE / REMARQUE

When outputs are turned on, they source power from EXTVCC to the output pin. If you use a channel as input, make sure you never turn on the corresponding output.

Lorsque les sorties sont activées, elles alimentent la broche de sortie à partir de l'EXTVCC. Si vous utilisez un canal comme entrée, assurez-vous de ne jamais activer la sortie correspondante.

## 4.6 Analog IO



10 1  
10pin 3.5mm connector

1	AOUT1
2	AOUT2
3	AOUT3
4	AOUT4
5	AGND
6	AIN1
7	AIN2
8	AIN3
9	AIN4
10	AGND (internally connected to pin 5)

table 11: digital IO connector

AGND is isolated from iX-Bus power supply, however analog inputs and outputs share the same ground reference.

The multi IO module provides 4 analog voltage input-ports with a voltage range from -10V to 10V. The inputs are isolated from digital ground. Input resistance is 1 MOhm.

The multi IO module provides 4 analog voltage output-ports with a voltage range from -10V to 10V. The outputs are isolated from digital ground.

**NOTICE / REMARQUE**

Make sure not to exceed the nominal 24mA load for all output-ports combined.

Assurez-vous de ne pas dépasser la charge nominale de 24mA pour tous les ports de sortie combinés.

## 5 Maintenance



### NOTICE / REMARQUE

Always follow common ESD practice when you service the product!

Pour réaliser la maintenance du produit, respectez toujours les pratiques ESD courantes !

To open the housing, you can remove the back panel or the front panel. Different maintenance tasks require one of them to be removed, others require full disassembly.

Task	Back Panel		Remarks
Replace CFast	remove		
Replace SD-card	remove		
Replace Battery			Complete disassemble

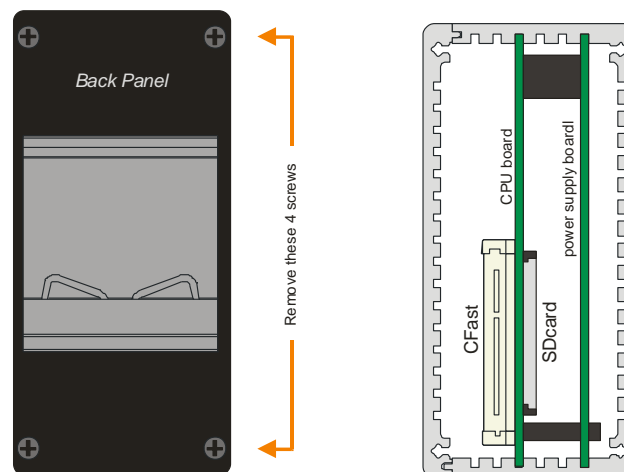


figure 11: emPC-A/iMX6 back panel removal

### 5.1 CFast Card Replacement



#### NOTICE / REMARQUE

Power must be turned off before removing or inserting the CFast card.

Couper l'alimentation avant de retirer ou d'insérer la carte CFast.

Refer to figure 11 to identify the location of the CFast card.

## 5.2 SDcard Replacement

**NOTICE / REMARQUE**

Power must be turned off before removing or inserting the SDcard.

Couper l'alimentation avant de retirer ou d'insérer la carte SD.

Refer to figure 11 to identify the location of the SDcard.



## 5.3 Battery Replacement (English)



### CAUTION : Fire Risk

The installed computer board is equipped with a Lithium battery. Danger of explosion if battery is incorrectly replaced. Replace only with battery of the same or equivalent type (3-volt lithium coin cell battery).

- Do not attempt to recharge the battery.
- Do not disassemble, crush, puncture, short external contacts, or dispose of in fire or water.



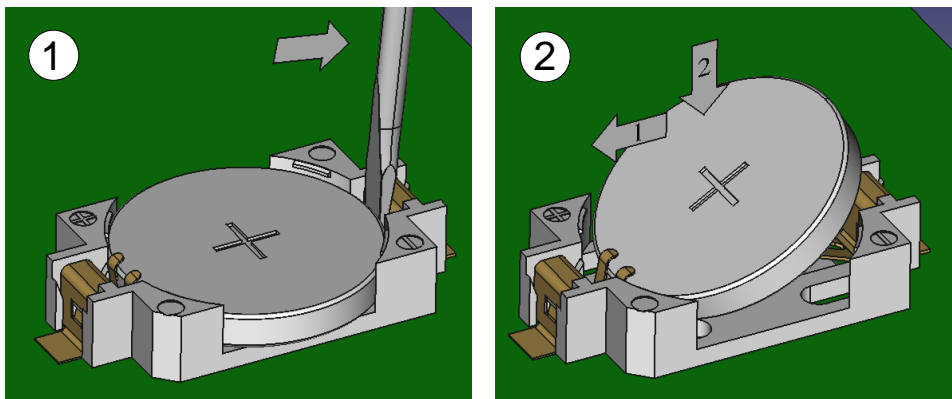
### NOTICE: Battery approval

The battery must be a compatible battery type: CR2032 (3 Volt lithium coin cell battery). The replacement battery must have a NRTL approval.

Compatible battery type: CR2032 (3 Volt lithium coin cell battery) with temperature range -40 .. +85°C or better (Recommended: Murata CR2032X or CR2032W).

The battery is used for backing up the system time when the power supply is removed.

1. Turn off the computer properly through the operating system, then turn off any external devices.
2. Disconnect the power supply from the power inlet and disconnect any external devices.
3. Disassemble the housing and locate the battery on the power supply board
4. Remove the battery from the holder (See figure 12)
5. Insert the new battery (See figure 12)
6. Reassemble the housing



1. Removal: Insert screwdriver at right side and bend so that the battery pops out. Use only gentle force, otherwise the battery holder might be damaged.  
The use a plastic tool is preferred to avoid shorting the battery
2. Insertion: Align new battery to the left side of the holder and gently press down on the right side of the battery until the battery snaps into the holder.

figure 12: Removing and replacing coin cell battery

## 5.4 Changer la pile (Français)



### MISE EN GARDE : Risque d'incendie

La carte informatique intégrée est équipée d'une pile au lithium.  
Risque d'explosion en cas de positionnement incorrect de la pile. Ne remplacer la pile qu'avec une pile du même type ou d'un type équivalent (pile au lithium de 3 volts).

- N'essayez pas de recharger la pile.
- Ne pas démonter, écraser, perforer, court-circuiter les contacts externes ou jeter dans l'eau ou le feu.



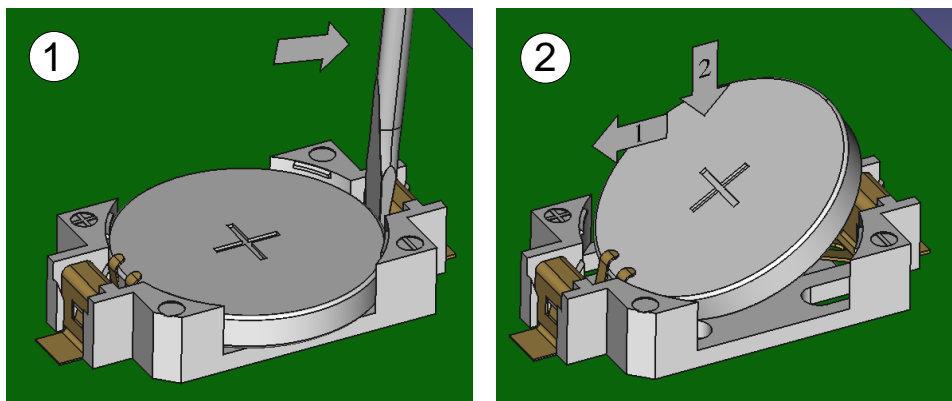
### REMARQUE : Homologation de la pile

La pile doit être compatible : CR2032 (pile au lithium de 3 volts). La pile de remplacement doit être homologuée NRTL.

Type de pile compatible : CR2032 (pile au lithium de 3 volts) avec une plage de température de -40 .. + 85 ° C ou supérieure. (Recommandé: Murata CR2032X ou CR2032W).

La batterie sert à sauvegarder l'heure du système lorsque l'alimentation électrique est coupée.

7. Éteignez correctement l'ordinateur via le système d'exploitation, puis éteignez tous les appareils externes.
8. Débranchez l'alimentation électrique de l'arrivée d'alimentation et débranchez tous les appareils externes.
9. Démontez le boîtier et placez la pile sur la carte d'alimentation.
10. Retirez la pile de son support (voir graphique 13).
11. Insérez la nouvelle pile (voir graphique 13).
12. Remonter le boîtier.



3. Changement de la pile : Insérez un tournevis sur le côté droit et abaissez-le de façon à ce que la pile sorte. N'exercez qu'une faible pression de sorte que le boîtier de la pile ne puisse pas être endommagé.  
Utilisez de préférence un outil en plastique pour ne pas risquer de court-circuiter la pile.
4. Insertion de la pile : Alignez la pile neuve sur le côté gauche du boîtier puis appuyez doucement sur le côté droit de la pile jusqu'à ce que la pile s'enclenche dans le boîtier.

graphique 13: Retirer et remplacer la pile au lithium

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To protect your rights, we need to make restrictions that forbid anyone to deny you these rights or to ask you to surrender the rights. These restrictions translate to certain responsibilities for you if you distribute copies of the library, or if you modify it.

For example, if you distribute copies of the library, whether gratis or for a fee, you must give the recipients all the rights that we gave you. You must make sure that they, too, receive or can get the source code. If you link a program with the library, you must provide complete object files to the recipients so that they can relink them with the library, after making changes to the library and recompiling it. And you must show them these terms so they know their rights.

Our method of protecting your rights has two steps: (1) copyright the library, and (2) offer you this license which gives you legal permission to copy, distribute and/or modify the library.

Also, for each distributor's protection, we want to make certain that everyone understands that there is no warranty for this free library. If the library is modified by someone else and passed on, we want its recipients to know that what they have is not the original version, so that any problems introduced by others will not reflect on the original authors' reputations.

Finally, any free program is threatened constantly by software patents. We wish to avoid the danger that companies distributing free software will individually obtain patent licenses, thus in effect transforming the program into proprietary software. To prevent this, we have made it clear that any patent must be licensed for everyone's free use or not licensed at all.

Most GNU software, including some libraries, is covered by the ordinary GNU General Public License, which was designed for utility programs. This license, the GNU Library General Public License, applies to certain designated libraries. This license is quite different from the ordinary one; be sure to read it in full, and don't assume that anything in it is the same as in the ordinary license.

The reason we have a separate public license for some libraries is that they blur the distinction we usually make between modifying or adding to a program and simply using it. Linking a program with a library, without changing the library, is in some sense simply using the library, and is analogous to running a utility program or application program. However, in a textual and legal sense, the linked executable is a combined work, a derivative of the original library, and the ordinary General Public License treats it as such.

Because of this blurred distinction, using the ordinary General Public License for libraries did not effectively promote software sharing, because most developers did not use the libraries. We concluded that weaker conditions might promote sharing better.

However, unrestricted linking of non-free programs would deprive the users of those programs of all benefit from the free status of the libraries themselves. This Library General Public License is intended to permit developers of non-free programs to use free libraries, while preserving your freedom as a user of such programs to change the free libraries that are incorporated in them. (We have not seen how to achieve this as regards changes in header files, but we have achieved it as regards changes in the actual functions of the Library.) The hope is that this will lead to faster development of free libraries.

The precise terms and conditions for copying, distribution and modification follow. Pay close attention to the difference between a "work based on the library" and a "work that uses the library". The former contains code derived from the library, while the latter only works together with the library.

Note that it is possible for a library to be covered by the ordinary General Public License rather than by this special one.

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A "library" means a collection of software functions and/or data prepared so as to be conveniently linked with application programs (which use some of those functions and data) to form executables.

The "Library", below, refers to any such software library or work which has been distributed under these terms. A "work based on the Library" means either the Library or any derivative work under copyright law: that is to say, a work containing the Library or a portion of it, either verbatim or with modifications and/or translated straightforwardly into another language. (Hereinafter, translation is included without limitation in the term "modification".)

"Source code" for a work means the preferred form of the work for making modifications to it. For a library, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the library.

Activities other than copying, distribution and modification are not covered by this License; they are outside its scope. The act of running a program using the Library is not restricted, and output from such a program is covered only if its contents constitute a work based on the Library (independent of the use of the Library in a tool for writing it). Whether that is true depends on what the Library does and what the program that uses the Library does.

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2. You may modify your copy or copies of the Library or any portion of it, thus forming a work based on the Library, and copy and distribute such modifications or work under the terms of Section 1 above, provided that you also meet all of these conditions:

a) The modified work must itself be a software library.

b) You must cause the files modified to carry prominent notices stating that you changed the files and the date of any change.

c) You must cause the whole of the work to be licensed at no charge to all third parties under the terms of this License.

d) If a facility in the modified Library refers to a function or a table of data to be supplied by an application program that uses the facility, other than as an argument passed when the facility is invoked, then you must make a good faith effort to ensure that, in the event an application does not supply such function or table, the facility still operates, and performs whatever part of its purpose remains meaningful.

(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table

used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Library, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Library, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Library.

In addition, mere aggregation of another work not based on the Library with the Library (or with a work based on the Library) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

3. You may opt to apply the terms of the ordinary GNU General Public License instead of this License to a given copy of the Library. To do this, you must alter all the notices that refer to this License, so that they refer to the ordinary GNU General Public License, version 2, instead of to this License. (If a newer version than version 2 of the ordinary GNU General Public License has appeared, then you can specify that version instead if you wish.) Do not make any other change in these notices.

Once this change is made in a given copy, it is irreversible for that copy, so the ordinary GNU General Public License applies to all subsequent copies and derivative works made from that copy.

This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

4. You may copy and distribute the Library (or a portion or derivative of it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange.

If distribution of object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to distribute the source code, even though third parties are not compelled to copy the source along with the object code.

5. A program that contains no derivative of any portion of the Library, but is designed to work with the Library by being compiled or linked with it, is called a "work that uses the Library". Such a work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License.

However, linking a "work that uses the Library" with the Library creates an executable that is a derivative of the Library (because it contains portions of the Library), rather than a "work that uses the library". The executable is therefore covered by this License. Section 6 states terms for distribution of such executables.

When a "work that uses the Library" uses material from a header file that is part of the Library, the object code for the work may be a derivative work of the Library even though the source code is not. Whether this is true is especially significant if the work can be linked without the Library, or if the work is itself a library. The threshold for this to be true is not precisely defined by law.

If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

6. As an exception to the Sections above, you may also compile or link a "work that uses the Library" with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer's own use and reverse engineering for debugging such modifications.

You must give prominent notice with each copy of the work that the Library is used in it and that the Library and its use are covered by this License. You must supply a copy of this License. If the work during execution

displays copyright notices, you must include the copyright notice for the Library among them, as well as a reference directing the user to the copy of this License. Also, you must do one of these things:

- a) Accompany the work with the complete corresponding machine-readable source code for the Library including whatever changes were used in the work (which must be distributed under Sections 1 and 2 above); and, if the work is an executable linked with the Library, with the complete machine-readable "work that uses the Library", as object code and/or source code, so that the user can modify the Library and then relink to produce a modified executable containing the modified Library. (It is understood that the user who changes the contents of definitions files in the Library will not necessarily be able to recompile the application to use the modified definitions.)
- b) Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.
- c) If distribution of the work is made by offering access to copy from a designated place, offer equivalent access to copy the above specified materials from the same place.
- d) Verify that the user has already received a copy of these materials or that you have already sent this user a copy.

For an executable, the required form of the "work that uses the Library" must include any data and utility programs needed for reproducing the executable from it. However, as a special exception, the source code distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

It may happen that this requirement contradicts the license restrictions of other proprietary libraries that do not normally accompany the operating system. Such a contradiction means you cannot use both them and the Library together in an executable that you distribute.

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Ty Coon, President of Vice

That's all there is to it!

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Version 2.1, February 1999

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We protect your rights with a two-step method: (1) we copyright the library, and (2) we offer you this license, which gives you legal permission to copy, distribute and/or modify the library.

To protect each distributor, we want to make it very clear that there is no warranty for the free library. Also, if the library is modified by someone else and passed on, the recipients should know that what they have is not the original version, so that the original author's reputation will not be affected by problems that might be introduced by others.

Finally, software patents pose a constant threat to the existence of any free program. We wish to make sure that a company cannot effectively restrict the users of a free program by obtaining a restrictive license from a patent holder. Therefore, we insist that any patent license obtained for a version of the library must be consistent with the full freedom of use specified in this license.

Most GNU software, including some libraries, is covered by the ordinary GNU General Public License. This license, the GNU Lesser General Public License, applies to certain designated libraries, and is quite different from the ordinary General Public License. We use this license for certain libraries in order to permit linking those libraries into non-free programs.

When a program is linked with a library, whether statically or using a shared library, the combination of the two is legally speaking a combined work, a derivative of the original library. The ordinary General Public License therefore permits such linking only if the entire combination fits its criteria of freedom. The Lesser General Public License permits more lax criteria for linking other code with the library.

We call this license the "Lesser" General Public License because it does Less to protect the user's freedom than the ordinary General Public License. It also provides other free software developers Less of an advantage over



competing non-free programs. These disadvantages are the reason we use the ordinary General Public License for many libraries. However, the Lesser license provides advantages in certain special circumstances.

For example, on rare occasions, there may be a special need to encourage the widest possible use of a certain library, so that it becomes a de-facto standard. To achieve this, non-free programs must be allowed to use the library. A more frequent case is that a free library does the same job as widely used non-free libraries. In this case, there is little to gain by limiting the free library to free software only, so we use the Lesser General Public License.

In other cases, permission to use a particular library in non-free programs enables a greater number of people to use a large body of free software. For example, permission to use the GNU C Library in non-free programs enables many more people to use the whole GNU operating system, as well as its variant, the GNU/Linux operating system.

Although the Lesser General Public License is Less protective of the users' freedom, it does ensure that the user of a program that is linked with the Library has the freedom and the wherewithal to run that program using a modified version of the Library.

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d) If a facility in the modified Library refers to a function or a table of data to be supplied by an application program that uses the facility, other than as an argument passed when the facility is invoked, then you must make a good faith effort to ensure that, in the event an application does not supply such function or table, the facility still operates, and performs whatever part of its purpose remains meaningful.

(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Library, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Library, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

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3. You may opt to apply the terms of the ordinary GNU General Public License instead of this License to a given copy of the Library. To do this, you must alter all the notices that refer to this License, so that they refer to the ordinary GNU General Public License, version 2, instead of to this License. (If a newer version than version 2 of the ordinary GNU General Public License has appeared, then you can specify that version instead if you wish.) Do not make any other change in these notices.

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This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

4. You may copy and distribute the Library (or a portion or derivative of it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange.

If distribution of object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to distribute the source code, even though third parties are not compelled to copy the source along with the object code.

5. A program that contains no derivative of any portion of the Library, but is designed to work with the Library by being compiled or linked with it, is called a "work that uses the Library". Such a work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License.

However, linking a "work that uses the Library" with the Library creates an executable that is a derivative of the Library (because it contains portions of the Library), rather than a "work that uses the library". The executable is therefore covered by this License. Section 6 states terms for distribution of such executables.

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If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

6. As an exception to the Sections above, you may also combine or link a "work that uses the Library" with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer's own use and reverse engineering for debugging such modifications.

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- b) Use a suitable shared library mechanism for linking with the Library. A suitable mechanism is one that (1) uses at run time a copy of the library already present on the user's computer system, rather than copying library functions into the executable, and (2) will operate properly with a modified version of the library, if the user installs one, as long as the modified version is interface-compatible with the version that the work was made with.
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## 7 Appendices

### 7.1 Technical Data

#### Processing Core

CPU	<b>emPC-A/iMX6S:</b> i.MX6 Solo ARM Cortex A9, 1 x 800 MHz, 512 KB L2 Cache
	<b>emPC-A/iMX6D:</b> i.MX6 Dual ARM Cortex A9, 2 x 800 MHz, 1 MB L2 Cache
	<b>emPC-A/iMX6Q:</b> i.MX6 Quad ARM Cortex A9, 4 x 800 MHz, 1 MB L2 Cache

#### Memory

Main Memory	1 GB DDR3 1066 for Solo 2 GB DDR3 1066 for Dual and Quad
Nonvolatile RAM	128 kB MRAM

#### Storage

CFast	1 x internal socket with SATA 3 GB/s (not available for Solo)
SDcard	1 x internal socket

#### Video

Controller	i.MX6 defined
Memory	Shared with main memory
Interface	1 x DVI-D single link connector on front panel, up to 1920x1200 1 x Single channel LVDS on internal connector, up to 1366x768

#### External Interfaces (connector panel)

Video	1 x DVI-D
Ethernet	1 x 10/100/1000 Mbit/s Ethernet (Ethernet 0: i.MX6 ENET) 1 x 10/100/1000 Mbit/s Ethernet (Ethernet 1: Intel i210)
USB	2 x USB2.0
CAN (Option)	SJA1000 controller <ul style="list-style-type: none"> <li>• ISO/DIS 11898-2 (isolated from logic),</li> <li>• software switchable 120 Ohm termination resistor</li> </ul>
Serial Port (Option)	i.MX6 UART <ul style="list-style-type: none"> <li>• RS232 (4 wire)</li> <li>• RS485, optionally isolated from logic</li> </ul> Exar 16V2750 (Port expansion) <ul style="list-style-type: none"> <li>• RS232 (full featured)</li> <li>• RS485, optionally isolated from logic</li> </ul>

#### Expansion

iX-Bus	Internal 8/16 bit interface for IO and low speed peripherals
--------	--

#### Indicators and Switches

Reset	Pushbutton
Status	LED for power supply status (green)
User LEDs	2 programmable LEDs (S0 – red and S1 - green)

#### System

Housing	Aluminium, passivated, outside painted
Battery	CR 2032, for real time clock



Watchdog Yes, implemented in i.MX6

### Power Requirements

Power Supply DC power, 9 .. 34 V (lower limit with adjustable UVL)  
 Current rating max. 2.5 A (limited by internal fuse, depending on part variant)  
 Inv.-pol. protection Yes  
 Fuse Internal 2.5A melting fuse in DC in, GND is unfused  
 potential separation No, GND (Pin 3 in Table 2) is connected to case  
 Inrush Current (max) TBD  
 Overvoltage Category I  
 Power Dissipation Without external load or expansion cards  
**emPC-A/iMX6Q: 9W (max)**  
**Digital IO Option: + 0.7 W**  
**Analog IO Option: + 3 W**

### External Load Capabilities

+5V (USB) Max. 0.5 A per USB port

### Environmental Specifications

Operating Ambient Temperature **emPC-A/iMX6Q base unit<sup>5)</sup>: -40 °C .. + 65 °C**  
**Parts with digital IO: -40 °C .. + 60 °C**  
**Parts with analog IO: 0 °C to 50 °C <sup>1)</sup>**  
 (with TÜV/NRTL approval) at sea level, derating of 1 °C per 300 m above sea level to a maximum of 2000 m.  
 Operating Ambient Temperature **emPC-A/iMX6Q: -40 °C ... +70 °C (up 75 °C with limited load) <sup>3)</sup>**  
**Parts with digital IO: -40 °C to 70 °C**  
**Parts with analog IO: 0 °C to 50 °C <sup>1)</sup>**  
 (without TÜV/NRTL approval) at sea level, derating of 1 °C per 300 m above sea level to a maximum of 2000 m.  
 Storage Temperature -40..+75 °C <sup>2)</sup>  
 Humidity 5%..95% r.H., non condensing  
 Ingress Protection IP20  
 Pollution Degree 2  
 Altitude max.2000m

### Physical Dimensions

Size (WxHxD) Including connectors and rail mounting bracket  
**2 DSUB: 52 x 105 x 117 mm**  
**4 DSUB: 72 x 105 x 117 mm**  
 Weight **2 DSUB: 600 g**  
**4 DSUB: 720 g**

### Notes

- 1 Accuracy limits not guaranteed over full operating temperature range
- 2 Operation and storage at high temperature will shorten RTC battery lifetime
- 3 Operation above 70 °C:
  - Total power consumption must be limited to 6W
  - Load to USB ports must be limited to 100 mA per port

Operation at 70 °C was verified using Linux with these conditions:

- `stress-ng --matrix 0 --matrix-method copy --matrix-size 256`
- external DVI Monitor (1920x1080) connected (frame buffer console only)
- Power Consumption w.o. ext. load: 7.4 W

Operation at 75 °C was verified using Linux with these conditions:

- `stress-ng --matrix 3 --matrix-method copy --matrix-size 128`
- external DVI Monitor (1920x1080) connected (frame buffer console only)
- Power Consumption w.o. ext. load: 6.0 W

System Idle (70 °C) w.o. ext. load and no monitor: ~ 4 W

System Idle (70 °C) w.o. ext. load and DVI Monitor (1920x1080): ~ 4.8 W

Stress-ng matrix copy is a high power CPU stressor. The `-matrix` option specifies the number of cores on which the test is executed in parallel (0 = all cores)

4 Tested in climatic chamber

5 With 2 D-SUB and no analog/digital IO

## 7.2 References

These references direct you to manuals and specifications that you might need to know when you attempt to program the product. Most of the documents can be downloaded from the Internet. Look for the WWW servers of the component/chip manufacturers.

- [1] **SJA1000 Product specification**, Philips Semiconductor, Jan 04, 2000
- [2] **ixBus System Reference Manual**, Janz Tec AG

### WWW-References

Janz Tec AG  
Freescale

[www.janztec.com](http://www.janztec.com)  
[www.freescale.com](http://www.freescale.com)

## 7.3 Dimensions

Refer to figure 14 for the housing dimensions.

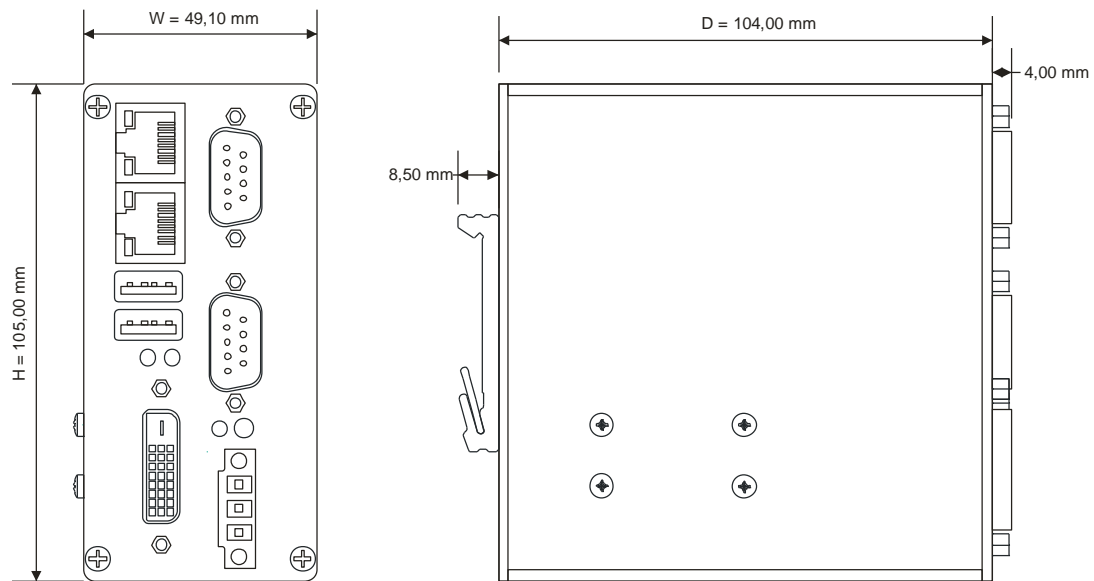


figure 14: housing dimensions (2 DSUB system shown)

emPC-A/iMX6 Systems with different IO options just differ in dimension W

Slot Variant	W
2 DSUB	49.1 mm
4 DSUB	69.5 mm
2 DSUB + analog/digital IO	69.5 mm

## 7.4 Product History

Version	Release Date	Name	Changes
			•

## 7.5 Manual History

Version	Release Date	Name	Changes
V1.0	2014-01-16	As	<ul style="list-style-type: none"> <li>Initial release</li> </ul>
V1.1	2014-01-20	As	<ul style="list-style-type: none"> <li>Technical Data: Removed system controller and changed DVI-I do DVI-D</li> <li>Removed "operating with hazardous voltages".</li> <li>Typographic changes</li> </ul>
V1.2	2015-05-22	ime	<ul style="list-style-type: none"> <li>Added Intended use</li> </ul>
V1.3	2015-10-05	As	<ul style="list-style-type: none"> <li>Added chapter Open Source Licensing</li> </ul>
V1.4	2018-07-20	As	<ul style="list-style-type: none"> <li>RS485: improved description of output signal D+/D- vs A/B</li> <li>Added analog/digital IO description</li> <li>Updated ambient temperature limits</li> </ul>
V1.5	2018-11-07	fhu	<ul style="list-style-type: none"> <li>Multi IO Module <ul style="list-style-type: none"> <li>Reduced digital IO Vmax to 31 V due to limits of EMC components. This is a specification change. This limit has been present on all previously shipped units. Units with higher voltage tolerance can be made on request.</li> <li>Clarified drawbacks when not connection EXTVCC in input only applications</li> <li>Added note that DIGIO voltage must not exceeded EXTVCC</li> </ul> </li> </ul>
V1.6	2019-02-07	As	<ul style="list-style-type: none"> <li>Operating conditions for +75 °C defined</li> <li>Revised technical data</li> <li>Added french safety notes</li> <li>Changes for TÜV/NTRL approval</li> <li>Changed RS485 self-receipt to non-standard behaviour</li> </ul>
V1.7	2022-06-07	As	<ul style="list-style-type: none"> <li>Updated recycling information</li> </ul>